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Japanese Patent application Unexamined Publication No.H10-286494

[Scope of Claim]

[Claim 1] A fluid jet nozzle having a tubular shape and allowing a fluid to pass through on its inner peripheral side to be jetted,

characterized in that a flat part with flexibility is formed.

[Claim 2] A fluid jet nozzle according to claim 1, characterized in that a weight part is provided on a jetting leading end side.

[Claim 3] A fluid jet nozzle according to claim 2, characterized in that the weight part has a hollow screw member to be screwed into an inner periphery on the jetting leading end side.

[Claim 4] A fluid jet gun, being communicated with a fluid supply source and comprising:

a holding part;

a nozzle capable of jetting a fluid supplied from the fluid supply source; and

a switching means for switching between states permitting and interrupting communication between the fluid supply source and the nozzle,

characterized in that the nozzle has a tubular shape, allows a fluid to pass through on its inner peripheral side, and includes a flat part with flexibility formed therein.

[Claim 5] A fluid jet gun according to claim 4, characterized in that the nozzle is provided with a weight part on its jetting leading end side.

[Claim 6] A fluid jet gun according to claim 5, characterized in that the weight part has a hollow screw member to be screwed into an inner periphery on the jetting leading end side of the nozzle.
[Claim 7] A fluid jet gun according to any one of claims 4 to 6, wherein a guide capable of sliding along a length direction of the nozzle is provided outside the flat part.

[Detailed Description of the Invention]

[0001]

[Technical Field to which the Invention belongs]

The present invention relates to a fluid jet nozzle and a fluid jet gun used in jetting gas, liquid, or a mixture of gas and liquid.

[0002]

[Prior Art]

A fluid jet gun is used in jetting a fluid such as gas, liquid, a mixture of gas and liquid, or the like. Such a fluid jet gun is communicated with a fluid supply source and includes a holding part, a nozzle capable of jetting a fluid supplied from the fluid supply source, and a switching means for switching between the states permitting and interrupting the communication between the fluid supply source and the nozzle. Conventionally, a nozzle having no flexibility is used.

[0003]

[Problem to be solved by the Invention]

Incidentally, in the above-mentioned conventional fluid jet

gun, for example, when it is used for cleaning work for removing dust by jetting air, the cleaning work is carried out while the gun is shaken and the location where air collides is changed back and forth. When the area to be cleaned is a wide area, there arises a problem in that a load is imposed on a worker due to the gun shaking work. In addition, since the jet force of a fluid is determined by the performance of a fluid supply source side or a channel form, there is also a problem in that the fluid jet gun cannot be adapted to the case where a stronger jet force is desired to be obtained.

[0004]

Hence, an object of the present invention is to provide a fluid jet nozzle and a fluid jet gun that can reduce the load imposed on a worker even when being used for cleaning work or the like and that can provide a stronger jet force.

[0005]

[Means for solving the Problem]

In order to achieve the above-mentioned object, a fluid jet nozzle according to the present invention has a tubular shape and allows a fluid to pass through on its inner peripheral side to be jetted, and is characterized in that a flat part with flexibility is formed. Thus, by the influence of the turbulent flow caused in a fluid passing through its inside and the force of the fluid in jetting, the flat part causes a reciprocating motion on the jetting leading end side while bending in its flattened direction.

[0006]

A fluid jet gun according to the present invention is communicated with a fluid supply source and includes: a holding part; a nozzle capable of jetting a fluid supplied from the fluid supply source; and a switching means for switching between states permitting and interrupting communication between the fluid supply source and the nozzle, and is characterized in that the nozzle has a tubular shape, allows a fluid to pass through on its inner peripheral side, and includes a flat part with flexibility formed therein. Thus, the flat part allows the nozzle to perform a reciprocating motion on the jetting leading end side while bending in the flattened direction by the influence of the turbulent flow caused in a fluid passing through its inside and the force of the fluid in jetting.

[0007]

[Embodiment Mode of the Invention]

An embodiment of the present invention is described with reference to the drawings as follows. FIG. 1 shows a fluid jet nozzle (hereinafter referred to as a "nozzle") 11 according to this embodiment. This nozzle 11 includes a tubular nozzle body 13 having a through hole 12 passing through along its length direction and a weight part 14 provided for the nozzle body 13 on its one end side. The nozzle body 13 as a whole is formed integrally of a flexible material such as nylon, polytetrafluoroethylene, polyurethane, or polypropylene to have a substantially constant wall thickness. In

its predetermined intermediate region, a flat part 16 having a so-called flattened form is formed with its width in one direction orthogonal to the length direction of the nozzle body 13 set to be narrower than that in the direction orthogonal to the length direction and the one direction. In predetermined regions on both sides of the flat part 16, i.e. at both ends of the nozzle body 13, cylindrical parts 17 and 18 with a cylindrical shape are formed, respectively. The flat part 16 is in the flattened form even in the state where the nozzle body 13 is linear along its length direction.

[0008]

The weight part 14 is composed of: a screw member 21 that has a substantially cylindrical shape with a through hole 20 formed to pass through its center along the axial direction and has a screw part 22 formed in the outer peripheral portion over its whole length to be screwed into the cylindrical part 17 on one side; and a cylindrical fitting member 23 allowing the cylindrical part 17 on the one side to be fitted thereinside. The screw member 21 is made of a metal material, and the fitting member 23 is made of an elastic material such as silicone. The screw member 21 is screwed into a internal thread part 24 formed in advance on the inner peripheral side of the cylindrical part 17. This screwing prevents the weight part 14 from coming off from the nozzle body 13. Note that the weight part 14 may be fixed simply with a force produced through the

deformation of the cylindrical part when the screw member 21 is screwed into the cylindrical part 17 without forming the internal thread part 24 on the inner peripheral side of the cylindrical part 17. Furthermore, in the fitting member 23, its inner diameter is set to be smaller than the outer diameter of the cylindrical part 17 screwed together with the screw member 21. Thus, the force produced through the deformation caused by fitting the cylindrical part 17 on its inner side prevents the weight part 14 from coming off from the cylindrical part 17. The fitting member 23 allows the cylindrical part 17 to be fit thereinto while a portion thereof into which the cylindrical part 17 is not fitted is provided on its one end side. This allows the fitting member 23 to cover a portion on the leading end side of the cylindrical part 17 by its elasticity to a degree that the fitting member 23 does not cover the through hole 20 of the screw member 21.

[0009]

FIG. 2 shows a fluid jet gun (hereinafter referred to as a "gun") 26 to which the above-mentioned nozzle 11 is attached. The gun 26 includes a holding part 27 to be held by a worker and a lever (a switching means) 28 provided swingably to be substantially parallel to the holding part 27. The gun 26 is held by a worker with the holding part 27 in the state that the lever 28 is positioned forward (direction of fingertips). The gun 26 includes: a guide portion 30 linearly extending from the holding part 27 in the opposite

direction to the lever 28; a bent portion 31 bent in a semicircular form from the opposite side to the holding part 27 of the guide portion 30; and an extending portion 32 linearly extending forward from the opposite side to the guide portion 30 of the bent portion 31 to be parallel with the guide portion 30. The guide portion 30, the bent portion 31, and the extending portion 32 are formed through bending of one cylindrical tubular body 33. An attaching part 34 is provided at the leading end of the extending portion 32. The nozzle 11 is attached to the attaching part 34 to be linear with the extending portion 32 in the state that the cylindrical part 18 on the opposite side to the weight part 14 is fitted. This nozzle 11 is attached so that, for example, the flattened direction (a narrower width direction) of the flat part 16 is the left-right direction with the holding part 27 disposed along the vertical direction, and in this attached state, its rotation is limited.

[0010]

This gun 26 is communicated with a fluid supply source, which is not shown in the figure, through a pipe, which is not shown in the figure, attached to a removable part 35 provided for the holding part 27 on its opposite side to the guide portion 30. The lever 28 is moved swingingly to the holding part 27 side, whereby a fluid supplied from the fluid supply source is jetted from the leading end portion on the weight part 14 side of the nozzle 11 through the respective inside portions of the holding part 27, the guide

portion 30, the bent portion 31, the extending portion 32, the attaching part 34, and the nozzle 11. Note that the lever 28 is urged in the opposite direction to the holding part 27 by a spring or the like. When releasing the swing movement of the lever 28 toward the side of the holding part 27, the lever 28 moves swingingly in the opposite direction to the holding part 27 by the urging force of the spring to stop the jetting from the leading end of the nozzle 11. Thus, the lever 28 switches between the states permitting and interrupting the communication between the fluid supply source and the nozzle 11.

[0011]

Additionally, the gun 26 is provided with a guide 37 that is slidable along the length direction of the nozzle 11. This guide 37 includes: a support part 38 that is supported removably and slidably with respect to the guide portion 30 and can be fixed to the guide portion 30 at an arbitrary position; a base part 39 fixed to the support part 38; and a guide body 40 fixed to the base part 39 to cover the outer side of the flat part 16 of the nozzle 11. The support part 38 has a clamp body 42 that clamps the guide portion 30 and is formed of a spring material and a pair of operation pieces 43 provided on both sides of the clamp body 42. When a worker holds the pair of operation pieces 43 from both sides in the direction allowing them to come close to each other, the clamp body 42 releases the clamping of the guide portion 30 and thus the guide 37 is allowed

to move along the guide portion 30. When the guide 37 is moved to a suitable position and then the clamping of the clamp body 42 is released, the clamp body 42 clamps the guide portion 30 and thus the guide 37 is fixed to the guide portion 30. The guide body 40 has a cylindrical shape and allows the nozzle 11 to be inserted and pass through thereinside along the axial direction with a gap provided between the nozzle 11 and the guide body 40, thereby covering the outer side of the nozzle 11. Then, the support part 38 is moved along the guide portion 30 as described above, whereby the guide body 40 is changed in position with respect to the nozzle 11.

[0012]

With the configuration as described above, when the lever 28 is moved swingingly in the direction of the holding part 27 and a fluid supplied from the fluid supply source is jetted from the leading end of the nozzle 11 through the inner peripheral side of the nozzle 11, a turbulent flow of the fluid is caused inside the nozzle 11 due to the variation in sectional shape between the cylindrical parts 17 and 18 and the flat part 16, pulsation of the fluid itself, and the like. By the influence of the turbulent flow and the force of the fluid in jetting, the flat part 16 of the nozzle 11 formed of a flexible material causes a reciprocating motion in its flattened direction on the jetting leading end side while bending in the flattened direction. Thus, since the portion on the leading end side of the nozzle 11 causes the reciprocating motion

automatically, it is no longer necessary to shake the gun even when cleaning work or the like is carried out and thereby the load imposed on a worker can be reduced. Moreover, the flat part 16 of the nozzle 11 has an extremely low stiffness in the flattened direction and therefore bends in the flattened direction. Thus, the direction of the reciprocation caused on the jetting leading end side can be fixed. Additionally, the high speed reciprocating motion of the nozzle 11 amplifies the pressure wave of the fluid to thereby cause powerful impulse waves to produce the fluid jet in a belt shape, whereby a stronger jet force can be obtained.

[0013]

In addition, since the weight part 14 is provided at the jetting leading end side of the nozzle 11, a reciprocating motion can be performed with higher amplitude at the jetting leading end side of the nozzle 11. Furthermore, since the hollow screw member 21 to be screwed into the inner periphery on the jetting leading end side of the nozzle 11 is used as the weight part 14, the attachment thereof is facilitated. Additionally, the guide 37 that is slidable along the length direction of the nozzle 11 is provided outside the flat part 16. This guide 37 allows both sides in the moving direction of the flat part 16 to come into contact therewith, thereby limiting the motion range, i.e. the amplitude of the reciprocating motion of the nozzle 11. When the guide 37 is moved to the jetting leading end side of the nozzle 11, the length of the nozzle 11 located

between the guide 37 and the jetting leading end is reduced and thus the amplitude of the reciprocating motion decreases. Therefore, when the guide 37 is moved away from the jetting leading end side of the nozzle 11, the length of the nozzle 11 located between the guide 37 and the jetting leading end is increased and thus the amplitude of the reciprocating motion increases. In this manner, the amplitude of the reciprocating motion of the jetting leading end of the nozzle 11 can be adjusted.

[0014]

When it is not necessary to adjust the amplitude of the reciprocating motion of the jetting leading end of the nozzle 11, it also is possible to fix the guide body 40 disposed outside the flat part 16 with respect to the gun 26. In this case, for example, as shown in FIG. 3, a configuration including a base part 46 fixed to the attaching part 34 and a cylindrical guide body 47 fixed to the base part 46 to cover the outer side of a predetermined position of the flat part 16 can be employed for the guide 45. The fluid described above denotes liquid, a mixture of gas and liquid, or the like besides gas such as air. When a mixture of gas and liquid is to be jetted, it is possible that, for example, the gas alone is allowed to be supplied from the fluid supply source, the liquid is allowed to be introduced into the gun 26, and the liquid is mixed with the gas according to the theory of a venturi tube, thereby being jetted. The cases where gas is to be jetted as the fluid include,

for instance, cleaning work for removing dust or work for removing water through jetting of air or the like. The cases where liquid is to be jetted as the fluid include, for example, a washing work in which a wash liquid is jetted against an object to be washed and the like. The cases where a mixture of gas and liquid is to be jetted include, for example, a coating work and the like.

[0015]

[Effect of the Invention]

As described above in detail, according to the fluid jet nozzle of the present invention, by the influence of the turbulent flow caused in a fluid passing through its inside and the force of the fluid in jetting, the flat part causes a reciprocating motion on the jetting leading end side while bending in its flattened direction. Thus, since the reciprocating motion is performed automatically at the leading end side, the use of this makes it no longer necessary to shake the fluid jet gun even when cleaning work or the like is carried out with the fluid jet gun, whereby the load imposed on a worker can be reduced. Moreover, the flat part has an extremely low stiffness in the flattened direction and therefore bends in the flattened direction. Thus, the direction of the reciprocation caused on the jetting leading end side can be fixed. Additionally, the high speed reciprocating motion of the nozzle amplifies the pressure wave of the fluid to thereby cause powerful impulse waves to produce the fluid jet in a belt shape, whereby a stronger jet

force can be obtained. In addition, the weight part is provided on the jetting leading end side, so that a reciprocating motion can be performed with higher amplitude at the jetting leading end side. Furthermore, when using the hollow screw member to be screwed into the inner periphery on the jetting leading end side as the weight part, the attachment thereof is facilitated.

[0016]

According to the fluid jet gun of the present invention, the flat part allows the nozzle to cause a reciprocating motion on the jetting leading end side while bending in the flattened direction by the influence of the turbulent flow caused in a fluid passing through its inside and the force of the fluid in jetting. Thus, since the reciprocating motion is performed automatically at the leading end side of the nozzle, it is no longer necessary to shake the gun even when cleaning work or the like is carried out, whereby the load imposed on a worker can be reduced. Moreover, the flat part of the nozzle has an extremely low stiffness in the flattened direction and therefore bends in the flattened direction. Thus, the direction of the reciprocation caused on the jetting leading end side can be fixed. Additionally, the high speed reciprocating motion of the nozzle amplifies the pressure wave of the fluid to thereby cause powerful impulse waves to produce the fluid jet in a belt shape, whereby a stronger jet force can be obtained. In addition, the weight part is provided on the jetting leading end

side of the nozzle, so that a reciprocating motion can be performed with higher amplitude at the jetting leading end side of the nozzle. Furthermore, when the hollow screw member to be screwed into the inner periphery on the jetting leading end side of the nozzle is used as the weight part, the attachment thereof is facilitated. Additionally, with the guide that is slidable along the length direction of the nozzle provided outside the flat part, when the guide is moved to the jetting leading end side of the nozzle, the length of the nozzle located between the guide and the jetting leading end is reduced and thus the amplitude of the reciprocating motion decreases, and when the guide is moved away from the jetting leading end side of the nozzle, the length of the nozzle located between the guide and the jetting leading end is increased, whereby the amplitude of the reciprocating motion increases. Thus, the amplitude of the reciprocating motion of the jetting leading end of the nozzle can be adjusted.

[Brief Description of the Drawings]

[FIG. 1] Diagrams showing an embodiment of a fluid jet nozzle of the present invention: FIG. 1(a) is a sectional view; FIG. 1(b) is a sectional view taken along line B-B shown in FIG. 1(a); and FIG. 1(c) is a sectional view taken along line C-C shown in FIG. 1(a).

[FIG. 2] A perspective view showing an embodiment of a fluid jet gun of the present invention.

[FIG. 3] A perspective view showing part of another embodiment of a fluid jet gun of the present invention.

[Description of Symbols]

11 Fluid jet nozzle

13 Nozzle body

14 Weight part

21 Screw member

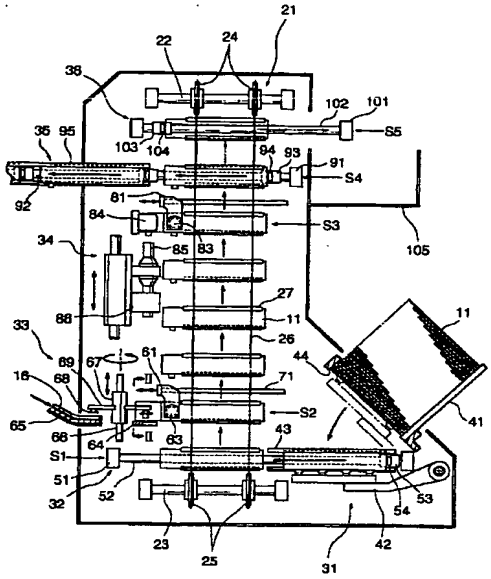
26 Fluid jet gun

27 Holding part

28 Lever (switching means)

37 Guide

【図1】



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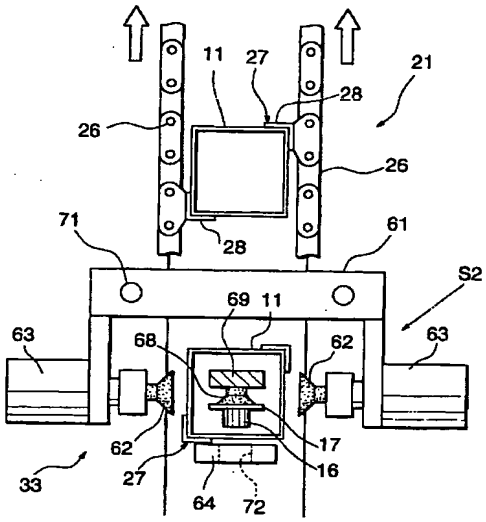

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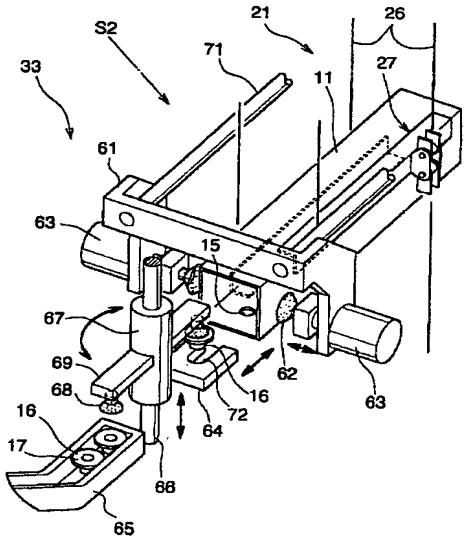

【図5】